

# NSRP | National Shipbuilding Research Program

## Power Panel & Breaker Commonality

**GENERAL DYNAMICS**  
Bath Iron Works

Rickey DeLoge - (207) 442-4153

06/21/17

PORTLAND, ME



DISTRIBUTION STATEMENT A: Approved for Public Release

# Agenda

- Mission Statement
- Summary
- Tasks
- Benefits of Commonality
- Schedule
- Recap
- Status



# Project Mission Statement

- Identify Where Opportunities Exist with Consolidating Power Panels and Circuit Breakers to Reduce the Number of Variants and Push Commonality into Ship Designs

OPPORTUNITY



# Project Summary

- Objectives:
  - Identify Existing Opportunities for Consolidation
  - Reduce the Number of Variants and Breaker – Panel Combinations
  - Drive **Commonality** into Ship Designs



# Project Tasks

- Create Power Panel and Breaker Master List 95% Complete
- Research & Determine Requirements 65% Complete
- Research Applicable Products 95% Complete
- Determine Product Opportunity 50% Complete
- Breaker Shock & Vibration Testing Procedure 0% Complete
- Design, Build, & Test Demonstrator 0% Complete
- Generate Report and Presentation 17% Complete

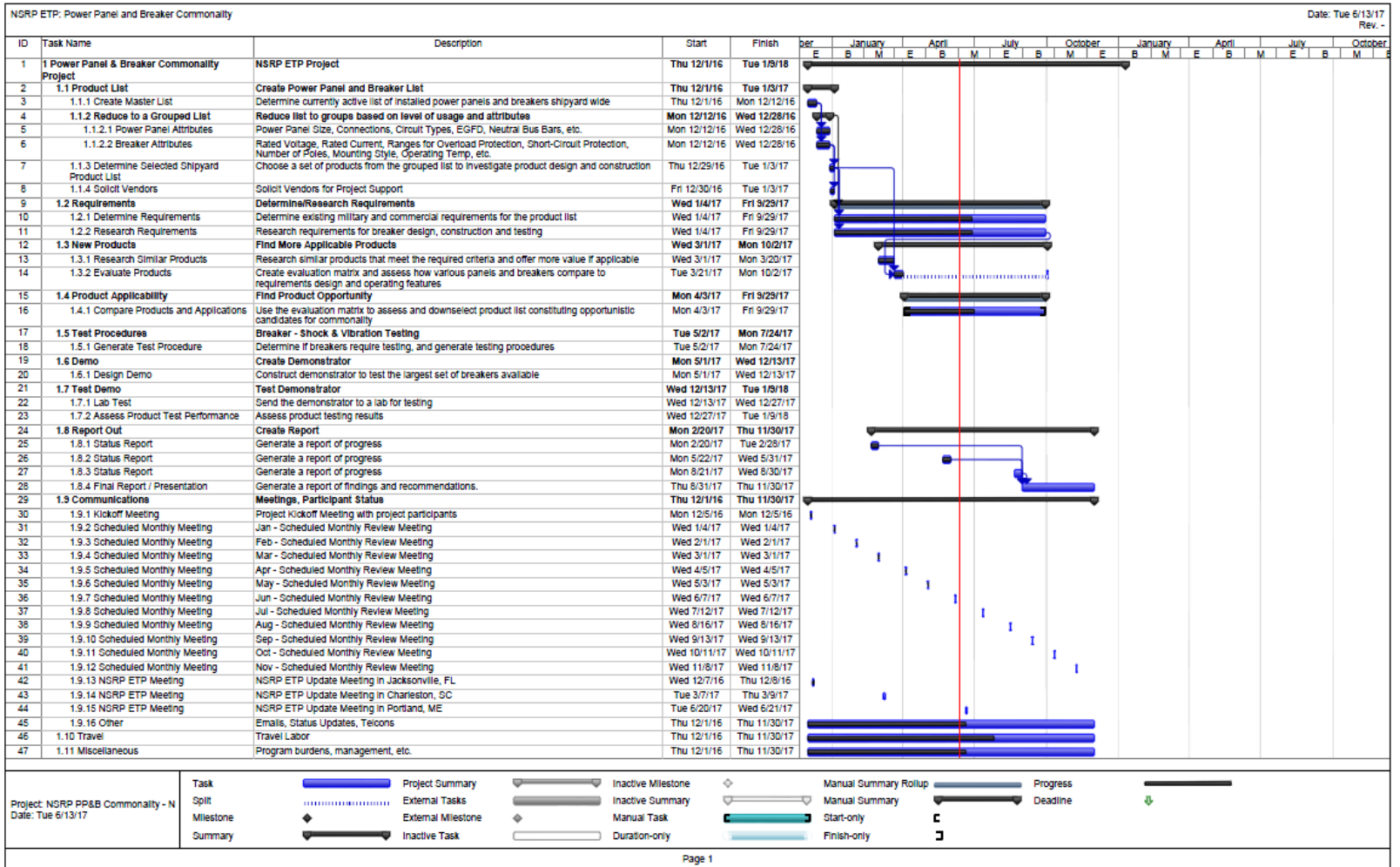


# Benefits of Commonality

- Inventory
  - Reduce Inventory / Provisioning / Spare Parts
  - Reduce Inventory Carrying Costs
  - Reduce Configuration Management Costs
    - Reduce Large Parts List
    - Reduce Number of Technical Manuals and Content
  - Improve Inventory Control
- Reduce Maintenance Costs
- Reduce Training
- Enable Simpler Designs
- Improve Affordability



# Project Schedule



# Overview From Previous Update

- Discussed the Creation of the Power Panel and Breaker Product List
  - Grouped Data Based Upon Attributes and Performance Requirements
  - Narrowed Commercial Product Search to Two Breaker Types
- Considered the Types of Requirements and Impacts From a Commercial Off The Shelf Product
  - Product Support
  - Performance Capabilities





# Commercial Applicability

- Researched Two Breaker Types for Potential Consolidation and Replacement (80+%)
  - AQB-A101
  - ALB-1
- COTS Breakers are Available Matching the Basic Ratings
  - No Difficulty Finding Equivalent Voltage & Amperage Ratings
  - UL489 Supplement SB Compliance Required for 50°C Rating



# Commercial Product Overview

- AQB-A101 – If Replaced by an Electronic COTS Product
  - UL489 has the Long Delay Nominally Set to Trip at Approximately 1.15x the Rated Current
    - To Replace with a COTS Electronic Breaker, Upscale the Rated Current (AQB-A101/100 A → COTS 150A)
      - Providing COTS Breaker is Fully Rated for:
        - » Mounting Within an Enclosure
        - » 50°C Ambient Temperature
  - Breaker Labeling may not Reflect Breaker Trip Characteristics
  - An Electronic COTS Breaker is as Expensive i.e. FDE → AQB-A103

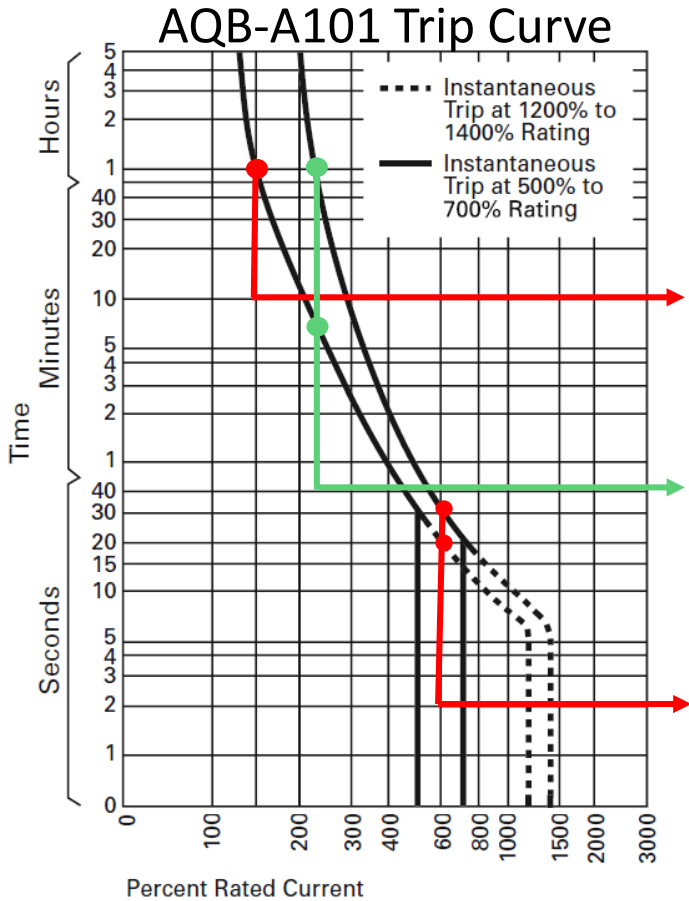


# Commercial Product Overview

- ALB-1 – If Replaced by a Thermal-Magnetic COTS Product
  - UL489 has the Long Delay Nominally Set to Trip at Approximately 1.15x the Rated Current
    - A Current Rating Upsize would be Required here as well
    - Supplemental SB Provides Vibration Testing / Labeling
  - Electronic Trip Breakers Offering an Adjustable CCS Dial are not Available (No Single Poles)
  - Discrete Frame Sizes are Available



# Requirements: AQB-A101 / MIL-C-17361



- **Required Tripping Characteristics 60HZ AQB-A101, 50°C**
  - 1.5x – Not Less than 1 Hour
  - 2.25x – Less than 1 Hour
  - 6x – Between 20 – 32 Seconds

- Required to Trip in Not Less than 3,600 Seconds at 1.5x
  - ✗ Most Commercial Breakers Trip around 500 Seconds

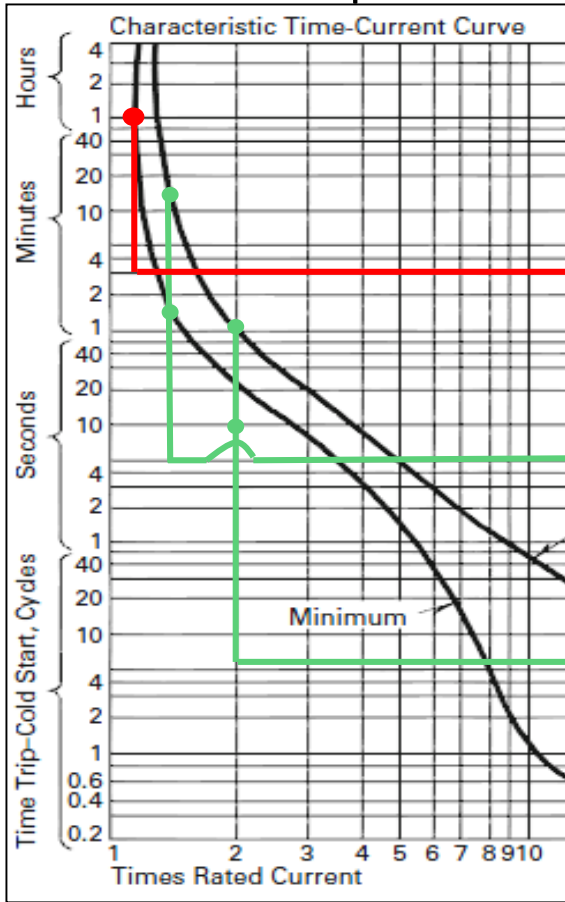
- Required to Trip in Less than 3,600 Seconds at 2.25x
  - ✓ Most Commercial Breakers Meet this Spec

- Required to Trip in 20-32 Seconds at 6x
  - ✗ Most Commercial Breakers Trip around 17 Seconds, Though, May Not Be a Deal Breaker



# Requirements: ALB-1 / MIL-C-17588

## ALB-1 Trip Curve



- **Required Tripping Characteristics for ALB-1, 50°C**

- 1.15x – Not Less than 1 Hour
- 1.38x – Less than 1 Hour
- 2x – Between 10 – 210 Seconds

- Required to Trip in Not Less than 3,600 Seconds at 1.15x  
X Most Commercial Breakers could Trip around 17 Minutes
- Required to Trip in Less than 3,600 Seconds at 1.38x  
✓ Most Commercial Breakers Meet this Spec
- Required to Trip in 10-210 Seconds at 2x  
✓ Most Commercial Breakers Can Be Adjusted on the Delay



# Requirement Thoughts

- What are the Largest Drivers Behind Incompatibility
  - Shock Certification
  - Long-Time Delay Pickup Setting
  - Deratings
- Possible to Develop MIL-Spec / Commercial Hybrid?
  - Navy / Non-Navy Use
    - Commercial Markets Use More Robust Products?
    - Can Navy Compromise Some Requirements?
- COTS – Once the Following Requirements are Met:
  - Long-Delay Trip Curves
  - 50°C Ambient Temperatures / Enclosures
  - Shock / Vibration Testing
- What Do You Have?



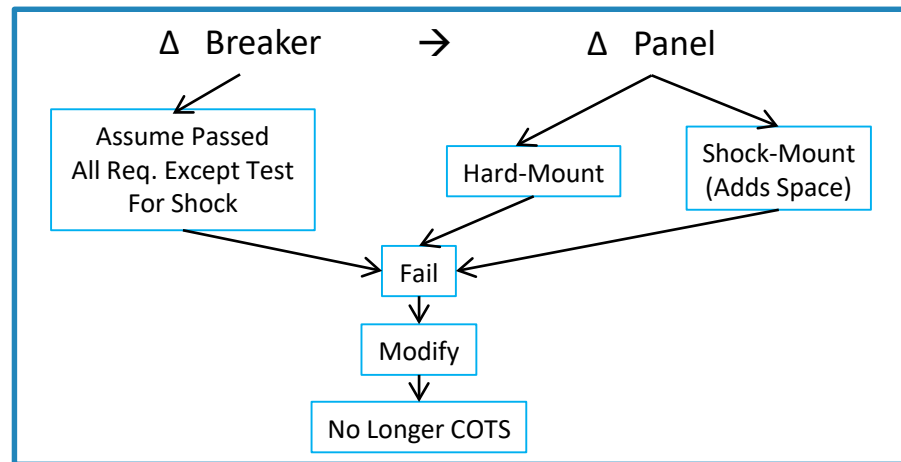
# Product Testing Determination

- The Long Delay Tripping Issue is a Function of the Commercial Regulatory Body Specifications; All Commercial Suppliers have this Issue
  - Products are Unable to Qualify for Navy Requirements
- Breaker Deratings ( $\approx 10\%$  Each)
  - Installed within an Enclosure
  - Ambient Temperature
- Applications Engineering Required (Issues in the Field)
- Commercial Product Turnover Rates (Obsolescence)



# Product Testing Determination

- If Relieved of the Trip Characteristic Requirements
  - Derating Issue
  - Shock Qualification Issue



- Testing Commercial Products for Lightweight Shock/Vibration will not be Pursued





# Path Forward – Option 1

- Investigate Currently Used MIL-Spec Products
  - Determine Breakers Which May Be:
    - Consolidated (Active Breakers)
    - Replaced (AQB-A101 for AQB-A50)
    - Eliminated (Spare Circuits)
  - Based on Breaker Outcomes:
    - Reduce the Quantity of Power Panels by Consolidating
    - Eliminate Unnecessary Power Panels



# Path Forward – Option 2

- Research the Possibility for the Creation of a New Spec and Product
  - Develop Single/Double Pole Variants of AQB-A101
  - Standardize on 4 (12 Pole), 8 (24 Pole), 12 (36 Pole) AQB-A101 Power Panels
  - New Standard Panels would be Appropriate for all Single Phase, Three Phase Applications
  - Potentially Eliminate All AQB-A50, ALB-1 Panels & Breakers (90+%)



“Knowing trees, I understand the meaning of patience.  
Knowing grass, I can appreciate persistence.”

-- Hal Borland



Refer to Title Page for Distribution Statement

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NSRP ETP



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